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**1.ROLE OF THE IMMUNE SYSTEM**

The major function of the immune system is to protect the body from environmental agents such as microbes or chemicals, thereby preserving the integrity of the body .The immune system is made up of special organs, cells, and chemicals that fight infection(microbes). The main parts of the immune system are: white blood cells, antibodies, the complement system, the lymphatic system, the spleen, the thymus, and the bone marrow. These are the parts of your immune system that actively fight infection.

* **White blood cells:** White blood cells are the key players in your immune system . They are made in your bone marrow and are part of your lymphatic system. White blood cells move through blood and tissue throughout your body, looking for foreign invaders(microbes) such as bacteria, viruses, parasites, and fungi. When they found them they launch an immune attack. White blood cells include lymphocytes(such as B-cells, T-cells and natural killers cells) etc.
* **Antibodies**: Antibodies help the body to fight microbes or the toxins (poisons) they produce. They do this by recognizing substances called antigens on the surface of the microbe or in chemicals they produce which mark the microbe or toxin as being foreign. The antibodies the mark these antigens for destruction. These are many cells protein and chemicals involved in this attack.
* **Complement system**: The complement system is made up proteins whose actions complement the work done by antibodies.
* **Lymphatic system**: The lymphatic system is a network of delicate tubes throughout the body. The main roles of the lymphatic system are to:

Manage the fluid levels in the body

React to bacteria

Deal with cancer cells

Deal with cells products and otherwise would result in diseases or disorders in the body

Absorb some of fats in our diet from the intestine in the body

The lymphatic system is made up of:

Lymph nodes( also called lymph glands)- which trap microbes

Lymph vessels- tubes that carry lymph, the colourless fluid that bathes your body’s tissues and contain infection-fighting white blood cells.

Spleen: The spleen is a blood-filtering organ that removes microbes and destroys old or damaged red blood cells. It also makes disease-fighting components of the immune system (including antibodies and lymphocytes).

* **Bone marrow**: Bone marrow is a spongy tissue found inside your bones. It produces the red blood cells our bodies need to carry oxygen the white blood cells we use to fight infection and the platelets we need to help our blood clot
* **Thymus**: The thymus filters and monitors your blood contents. It produces the white blood cells T-lymphocytes.

The body other defences against microbes include: skin, lungs, digestive tract, and other defences are: saliva and tears containing anti-bacterial enzymes that reduce the risk of infection. The constant flushing of the urinary tract and bowel also helps. And overactivity of the immune system can take many forms including: Allergic diseases, Autoimmune diseases and Fever is an immune system response.

**2.THE TWO TYPES OF IMMUNITY**

* **Innate immunity**: innate immunity is the first line of defense against pathogens and it is non- specific meaning it does not protect against any specific threat. It involves several types cell types, proteins and even as organ. The organ involved is the skin. The skin is part of the first line of defense. It protects the body and prevents pathogens from getting inside your body. Neutrophils, macrophages, and dendritic cells are all phagocytes. They recognize the warning flag, attack the pathogen and eat it a process known as phagocytosis. If a pathogen is too big for one cells alone, several cells attack at once.

NK cells on the other hand, identify infected cells(host cells) and activate the host cell’s death receptor pathway or give the cell a lethal injection (injecting enzymes that degrade proteins). Host cells even try to fight back by turning off machinery that would help the pathogen and sending out distress signals. If the pathogens make it through all this it’s time adaptive immunity to step in and they do this with the help of dendritic cells. The innate immunity is the immune system a human is born with and mainly consist of barriers on and in the body that keep foreign threats out. Component of the innate immunity include skin, stomach acid, enzymes found in tears and skin oils, mucus and cough reflex. There are also chemical components of innate immunity, including substances called interferon and interleukin-1

* **Adaptive immunity**: adaptive immunity targets specific threats to the body. Adaptive immunity is more complex than innate immunity. In adaptive immunity the threat must be processed and recognized by the body and then the immune system creates antibodies specifically designed to the threat. After the threat is neutralized the adaptive system “remembers “ it which makes future responses to the same germ more efficient. Adaptive immunity works slower than innate and is more specific . There two types of immunity under adaptive immunity : passive and active immunity

Passive immunity occurs when antibodies are passed from one person to another, as through transfusion for example. The active immunity involves two types of white blood cells – T -cells and B-cells. Dendritic cells, after they have eaten and digested the pathogen, present the pieces to T-cells which activates. T-cells are formed in the thymus and cruise around until activated. Since T-cells require direct contact with other cells, T-cells immunity is termed cell-mediated immunity. Activated T-cells becomes helper cells (TH) and cytotoxic (killer) T-cells. They recognize and cause the destruction of infected cells.

3.DIFFERENT TYPES OF ANTIBODIES AND THEIR ROLES

There are five different antibodies isotypes seen in humans: IgG, IgA, IgM, IgE, and IgD

* IgG: Is an antibody isotype that most people think of when they are talking about antibodies. It is the antibody that is built by immunization. It activates an immune cascade that can eliminate some forms of infection IgA can also neutralizes certain toxins. It is the most abundant antibody isotype in the blood (plasma) accounting for 70-75% of human immunoglobulins (antibodies). IgA detoxifies harmful substances and is important in the recognition of antigen- antibody complexes by leukocytes and macrophages. IgG is transferred to the fetus through the placenta and protects the infant until its own immune system is functional.
* IgM: is one of the first type of antibody to be produced after a pathogen has entered the body .since it is made up of five Ig subunits bound together, it has very high avidity. In other words it sticks very strongly to its target. IgM is very important in the early stages of an infection. IgM sometimes appears when an infection becomes reactivated such as with herpes outbreak. It can also appear when someone is reexposed to a disease they have not gotten rid of. IgM usually circulates in the blood accounting for about 10% of human immunoglobulins. IgM has a pentametric structure in which five basics Y-shaped molecules are linked together.
* IgA: Is an antibody isotype that is found in usually mucosal areas, such as mouth, and the vaginal. It can be found in saliva, tears, and breast milk. IgA is formed by two Ig subunits bound together. When IgA binds to a target, it can stimulate inflammation. In a mucosal areas, IgA can also keep pathogens from sticking to epithelial cells. The production of IgA against inappropriate targets is associated with certain autoimmune disease, such as celiac disease. IgA is abundant in serum accounting for 10-15% of human immunoglobulins. IgA formers dimers( i.e , two IgA monomers joined together). IgA in breast milk protects the gastrointestinal tract of neonates from pathogens.
* IgE: Is an antibody that is responsible for allergic response. It is mostly found in the lungs, skin, and mucous membranes. When IgE binds to an allergen, it starts the histamine reaction. It is the histamine reaction that causes the symptoms of an allergy attack. This single subunit antibody also helps to protect the body from parasitic worms. IgE is present in minute amounts accounting for no more than 0.001% of human immunoglobulins .its original role is to protect against parasites.
* IgD: It is important in early stages of the immune response. Bound to B cells, it does not circulate .instead it signals those cells to become active. This can help to stimulate inflammation . IgD is the least understood type of antibody and its function are being discovered. IgD accounts for less 1% of human immunoglobulins.

B cells expressing plasma membrane –bound IgM and IgD (mature B cells) are activated upon encounter with a specific antigen, and begin to proliferate and produce secretory IgM and IgD. With further activation by the antigen or other stimuli these mature B cells differentiate into cells that produce increasing amounts of secreted immunoglobulins, and start to produce immunoglobulins isotypes other than IgM and IgD. This process is called “immunoglobulin class switching” .

Factors in the B cell environment (including hormones secreted by T-cells {cytokines} direct the isotype switching